AMENDMENTS TO THE CLAIMS

This listing of claims will replace all prior versions and listings of claims in the application.

Listing of Claims:

1. (currently amended) An apparatus for anti-islanding protection of a distributed generation with respect to a feeder connected to an electrical grid, the apparatus comprising:

a sensor adapted to generate a voltage signal representative of an output voltage at the distributed generation, a current signal representative of an output current at the distributed generation, or any combination of signals comprising at least one of the foregoing; and

a controller responsive to the signals from the sensor, and productive of a control signal directed to the distributed generation to drive an operating characteristic of the distributed generation out of a nominal range in response to the electrical grid being disconnected from the feeder;

wherein the controller is configured to analyze the sensor voltage and current signals in a vector format such that the resulting control signal is capable of driving both a voltage magnitude and a frequency magnitude of the distributed generation out of a nominal range.

2. (original) The apparatus of Claim 1, further comprising:

a monitor responsive to the operating characteristic of the distributed generation being driven out of a nominal range, and productive of a trip signal for disconnecting the distributed generation from the feeder.

3. (original) The apparatus of Claim 1, wherein the operating characteristic is an output voltage, an output frequency, or both an output voltage and an output frequency of the distributed generation.

4. (original) The apparatus of Claim 1, wherein:

the controller is adapted to transform the signals from the sensor from stationary coordinates to rotating coordinates, generate a control signal in rotating coordinates, transform the control signal from rotating coordinates to stationary coordinates to produce an output control signal, and send the output control signal to the distributed generation.

5. (original) The apparatus of Claim 4, further wherein:

the controller is adapted to:

in rotating coordinates, generate a frequency signal representative of a frequency at the distributed generation;

in rotating coordinates, modify at least one of a current reference and a power reference in response to at least one of the voltage signal, the current signal, and the frequency signal; and

in rotating coordinates, generate the control signal in response to a modified current reference or power reference.

6. (original) The apparatus of Claim 5, further wherein:

the controller is adapted to:

in rotating coordinates, generate a voltage variation signal in response to the voltage signal;

in rotating coordinates, generate a frequency variation signal in response to the frequency signal;

in rotating coordinates, generate a current variation signal in response to at least one of the voltage variation signal, and the frequency variation signal; and

modify the current reference in response to the current variation signal.

7. (original) A controller for anti-islanding protection of a distributed generation with respect to a feeder of an electrical grid, the distributed generation adapted for connection to the feeder via a distributed generation disconnect, the distributed generation disconnect responsive to a voltage/frequency monitor, the controller comprising:

an input converter adapted to transform a voltage signal from the distributed generation from stationary coordinates to rotating coordinates;

an input converter adapted to transform a current signal from the distributed generation from stationary coordinates to rotating coordinates;

a frequency signal generator adapted to provide a frequency signal representative of an output frequency of the distributed generation;

a current regulator adapted to provide a control signal to the distributed generation;

an integrator responsive to the voltage signal, the current signal, the frequency signal, or any combination comprising at least one of the foregoing signals, and adapted to provide an integrated signal to the current regulator; and

an output converter responsive to the control signal, the frequency signal, or any combination comprising at least one of the foregoing signals, and adapted to transform the control signal from rotating coordinates to stationary coordinates;

wherein a disconnected electrical grid results in the voltage and/or frequency at the distributed generation being driven away from a nominal range and the distributed generation disconnect being opened, thereby isolating the distributed generation with respect to the feeder.

8. (original) The controller of Claim 7, further comprising:

a current variation signal generator responsive to the voltage signal in rotating coordinates and adapted to provide a current variation signal to the integrator.

9. (original) The controller of claim 7, wherein the frequency signal generator comprises a phase-locked loop operational in rotating coordinates.

10. (original) The controller of Claim 9, further comprising:

a current variation signal generator responsive to the frequency signal in rotating coordinates and adapted to provide a current variation signal to the integrator.

11. (original) The controller of Claim 8, wherein the current variation signal generator comprises a bandpass filter, an amplifier, and a limiter.

12. (original) The controller of Claim 10, wherein the current variation signal generator comprises a bandpass filter, an amplifier, and a limiter.

13. (original) The controller of Claim 7, wherein:

in response to a disconnected electrical grid, the control signal drives the voltage and/or frequency at the distributed generation away from a nominal range in such a manner that an over voltage condition, and under voltage condition, an over frequency condition, an under frequency condition, or any combination comprising at least one of the foregoing conditions, results at the distributed generation.

14. (original) The controller of Claim 7, further comprising:

a plurality of signal paths adapted to receive and communicate signals with respect to a single-phase two-wire distributed generation, a two-phase three-wire distributed generation, a three-phase three-wire distributed generation, a three-phase four-wire distributed generation, or a multi-phase inverter.

15. (original) A method for anti-islanding protection of a distributed generation with respect to a feeder connected to an electrical grid, the method comprising:

determining an output voltage of the distributed generation;

determining an output current of the distributed generation;

determining an output voltage variation of the distributed generation;

modifying a current reference of the distributed generation in response to the output voltage variation;

determining an output frequency of the distributed generation in response to the output voltage; and

providing a control signal in response to the output current, the modified current reference, and the output frequency, for disconnecting the distributed generation from the feeder in response to the electrical grid being disconnected from the feeder.

16. (original) The method of Claim 15, wherein the providing a control signal further comprises:

providing a control signal such that both the output voltage and the output frequency of the distributed generation are driven out of their respective nominal ranges.

17. (original) The method of Claim 15, further comprising:

transforming a signal representative of the output voltage in stationary coordinates to a signal representative of the output voltage in rotating coordinates; and

wherein the modifying a current reference comprises determining a current variation in response to the output voltage variation and integrating the current variation with the current reference.

18. (original) The method of Claim 15, further comprising;

determining a frequency variation; and

modifying the current reference in response to the frequency variation.

19. (original) The method of Claim 18, wherein:

the modifying a current reference comprises determining a current variation in response to the frequency variation and integrating the current variation with the current reference.

20. (original) A computer program product for anti-islanding protection of a distributed generation adapted for signal communication with an electrical grid, the program comprising:

a storage medium, readable by a processing circuit, storing instructions for execution by the processing circuit for:

determining an output voltage of the distributed generation;

determining an output current of the distributed generation;

determining an output voltage variation of the distributed generation;

modifying a current reference of the distributed generation in response to the output voltage variation;

determining an output frequency of the distributed generation in response to the output voltage; and

providing a control signal in response to the output current, the modified current reference, and the output frequency, for disconnecting the distributed generation from a feeder in response to the electrical grid being disconnected from the feeder.

21. (original) The program of Claim 20, further comprising instructions for execution by the processing circuit for:

providing a control signal such that both the output voltage and the output frequency of the distributed generation are driven out of their respective nominal ranges.

22. (original) The program of Claim 20, further comprising instructions for execution by the processing circuit for:

transforming a signal representative of the output voltage in stationary coordinates to a signal representative of the output voltage in rotating coordinates; and

wherein the instructions for modifying a current reference comprises instructions for determining a current variation in response to the output voltage variation and instructions for integrating the current variation with the current reference.

23. (original) The program of Claim 20, further comprising instructions for execution by the processing circuit for:

determining the output frequency in rotating coordinates and determining a frequency variation therefrom; and

modifying the current reference in response to the frequency variation.

24. (original) The program of Claim 23, wherein:

the instructions for modifying the current reference comprises instructions for determining a current variation in response to the frequency variation and instructions for integrating the current variation with the current reference.

25. (original) An apparatus for anti-islanding protection of a distributed generation with respect to a feeder connected to an electrical grid, the apparatus comprising:

means for determining an output voltage of the distributed generation;

means for determining an output current of the distributed generation;

means for determining an output voltage variation of the distributed generation;

means for modifying a current reference of the distributed generation in response to the output voltage variation;

means for determining an output frequency of the distributed generation; and

means for providing a control signal in response to the output current, the modified current reference, and the output frequency, for disconnecting the distributed generation from the feeder in response to the electrical grid being disconnected from the feeder.

26. (original) The apparatus of Claim 25, wherein the means for providing a control signal further comprises:

means for providing a control signal such that both the output voltage and the output frequency of the distributed generation are driven out of their respective nominal ranges.

27. (original) The apparatus of Claim 25, further comprising means for transforming a signal representative of the output voltage in stationary coordinates to a signal representative of the output voltage in rotating coordinates;

wherein the means for determining an output voltage variation comprises a bandpass filter; and

wherein the means for modifying a current reference comprises means for determining a current variation in response to the output voltage variation and means for integrating the current variation with the current reference.

28. (original) The apparatus of Claim 27, wherein the means for determining a current variation comprises an amplifier and a limiter.

29. (original) The apparatus of Claim 25, wherein:

the means for determining an output voltage comprises means for determining an output under voltage, means for determining an output over voltage, or any combination comprising at least one of the foregoing means; and

the means for determining an output frequency comprises means for determining an output under frequency, means for determining an output over frequency, or any combination comprising at least one of the foregoing means.

30. (original) The apparatus of Claim 25, wherein the means for determining an output frequency comprises a phase-locked loop operational in rotating coordinates, and further comprising:

means for determining a frequency variation; and

means for modifying the current reference in response to the frequency variation

31. (original) The apparatus of Claim 30, wherein:

the means for determining a frequency variation comprises a bandpass filter; and

the means for modifying a current reference comprises means for determining a current variation in response to the frequency variation and means for integrating the current variation with the current reference.

32. (original) The apparatus of Claim 31, wherein the means for determining a current variation comprises an amplifier and a limiter.

33. (original) The apparatus of Claim 25, wherein the distributed generation comprises a single-phase two-wire distributed generation, a two-phase three-wire distributed generation, a three-phase three-wire distributed generation, a three-phase four-wire distributed generation, or a multi-phase inverter.